E 8 A 69.

E & A

# CONTROL OF THE MELON APHIS

(ATTACKS CUCUMBERS, MELONS, OTHER CUCURBITS, COTTON, ORANGES, ETC.)

IMP. BUR.
29 OCT. 1918
ENTOM

F. H. CHITTENDEN

Entomologist in Charge of Truck Crop Insect Investigations

Lifting vines for underspraying against the melon aphis

FARMERS' BULLETIN 914

UNITED STATES DEPARTMENT OF AGRICULTURE

Contribution from the Bureau of Entomology

L. O. HOWARD, Chief

Washington, D. C. February, 1918

Show this bulletin to a neighbor. Additional copies may be obtained free from the Division of Publications, United States Department of Agriculture

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1918

NEXT to the striped cucumber beetle the melon aphis, or "melon louse," is our most important cucumber insect pest and probably the most serious enemy of melons and related crops in this country. It works quickly, sucking the juices of the plants and causing them to wither and die, often before insect injury is suspected. Large fields often are destroyed in a few days.

This insect is minute, of some shade of green, from pale to nearly black, and in its younger stages is louselike in appearance. When numerous the melon "lice" develop wings and fly to various crops and are likely to be found first on cotton, okra, orange, and related plants, and on weeds.

Although, fortunately for us, the melon aphis has more than 40 insect enemies which hold it in check in many regions much of the time, artificial control becomes imperative when weather conditions are unfavorable to its parasites.

This bulletin describes several methods of control, the most important of which is spraying with nicotine sulphate, as described on pages 11 and 12. Keep a constant lookout for first signs of injury and employ control measures promptly on the appearance of the insect; otherwise the entire crop may be lost. Be careful to select the best spraying devices appropriate for work against this pest, as described on pages 13 and 14.

# CONTROL OF THE MELON APHIS.

CONTENTS.


| | Page. |
|---|---|
| Nature of attack | 3 |
| Description | 4 |
| Economic importance | 5 |
| Distribution | 6 |
| Seasonal history | 6 |
| Food plants | 7 |
| Natural enemies | 8 |
| Methods of control | 10 |
| Value of frequent inspections and early work | 10 |
| General considerations with regard to spraying | 10 |
| Methods of control—Continued. | |
| Spraying with nicotine sulphate | 11 |
| Spraying with soaps | 12 |
| Spraying with kerosene emulsion | 12 |
| Sprinkling or spraying with water | 13 |
| Spraying machinery and appliances | 13 |
| Carbon disulphid fumigation | 15 |
| Cultural methods | 15 |
| Conclusions | 16 |


## NATURE OF ATTACK.

THE MELON APHIS,[1] or, as it is commonly known, "melon louse," injures plants by piercing them with its beak and sapping their vitality. It occurs from early spring to late autumn on cantaloupes and other melons, cucumbers and other cucurbits, and on many other crop plants, and in seasons which favor its increase, notably in summers following springs that are cool and rainy, it frequently develops in enormous numbers and does very serious damage, collecting in masses on the under surface of the leaves of plants and causing them to curl, shrivel, and lose color, and interfering with the ultimate development of the fruit. Often it kills plants outright and destroys whole fields or reduces greatly the yield of fruit. An affected cantaloupe plant is shown in figure 1.

The melon aphis, like others of its kind, excretes "honeydew," but not so copiously as most injurious plant-lice; for example, certain forms which affect trees. When the melon aphis becomes unusually abundant, however, the honeydew covers the leaves of the affected plants with a thin, sticky coating to which the white molted skins of the insects adhere, and this attracts attention to injury, as does also the wilting and dying down of the plants. Many persons who notice the honeydew are unaware of the presence of the insects. They speak of the injury as "honeydew," and have even applied this name to the insect itself.[2]

[1] *Aphis gossypii* Glover; suborder Homoptera, family Aphididae.

[2] Attack by many forms of plant-lice, especially those which excrete honeydew more copiously than others, can be detected readily by the presence of insects which feed on the sweet excretion. Among these are flies, wasps, bees, and especially ants. The melon aphis, however, is not an especial favorite with ants, although some common species are occasionally found in attendance upon it.

Too frequently it happens that by the time the presence of the melon aphis in injurious numbers is noticed irreparable damage has been accomplished and the insects for the most part have migrated to other pastures. It is advisable, therefore, that remedial measures be undertaken *before* the aphis injury becomes conspicuous.

## DESCRIPTION.

The melon aphis (fig. 2) is a minute, soft-bodied creature of sluggish habit and variable color, usually some shade of green or greenish black, and in its young and wingless stages louselike in appearance. The egg is regularly oval and about one-fortieth of an inch in length, yellowish or greenish when first deposited, but soon changing to jet black. The young aphis, or nymph (fig. 2, *b*), when first born or hatched is less than one-fiftieth of an inch in length and nearly colorless, but later it turns yellowish. The last nymphal stage, corresponding to the pupa or cocoon stage of other insects, although not inactive, is shown at *c* in figure 2, and the adult wingless female which reproduces by giving birth to living young is shown at *d*. The body color of the adult insect varies from pale yellow to very dark green. The nectaries, or honey tubes, are black and the antennæ and legs yellowish white. The wingless female is from one-sixteenth to one-fourteenth of an inch long. The winged female is

FIG. 1.—Cantaloupe leaves showing curling caused by the melon aphis; insects in view on lower surface and on tendril.

shown in figure 2 at *a*. In this form the body is more slender than in the wingless form, and the length is from one-twentieth to one-fourteenth of an inch. A darker form of the female is shown in profile at *ab* in figure 2 and one of the antennæ, or feelers, greatly enlarged, at *aa*. The male of this species has not yet been described.

## ECONOMIC IMPORTANCE.

The melon aphis is by far the most abundant and destructive aphis affecting cucumbers, melons, and other cucurbits, and is not likely

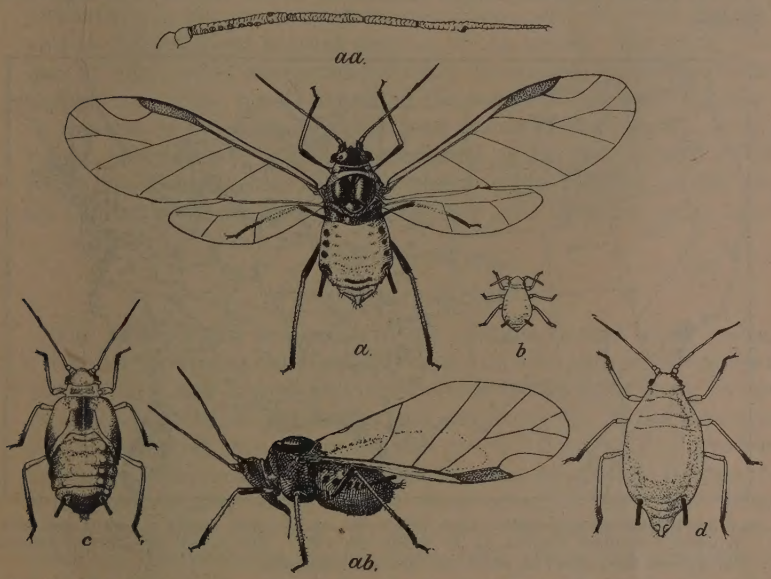


FIG. 2.—The melon aphis: *a*, Winged female; *aa*, enlarged antenna of same; *ab*, dark female, side view; *b*, young nymph; *c*, last stage of nymph; *d*, wingless female. All enlarged greatly.

to be confused with any other species occurring habitually on the same class of plants.[1] It is, indeed, a pest of the highest importance and, taken season after season, the most destructive aphis occurring in this country. The records of the Bureau of Entomology show that the complaints of injury are only one-third less in number than of the striped cucumber beetle, indicating that this aphis ranks at least second as a cucumber and melon pest.

As an instance of the damage done by the melon aphis in a single year, a pickle company at Omaha, Nebr., reported a loss of between

[1] The squash aphis (*Macrosiphum cucurbitae* Middleton), a much larger species and more uniformly lighter and brighter green, attacks cucurbits, but seldom in sufficient numbers to cause noticeable damage.

30,000 and 50,000 bushels of cucumbers, and one company in Texas estimated their loss at fully $20,000.

## DISTRIBUTION.

The original home of the melon aphis is doubtful, but it is probably in the Tropics, as this insect shows a decided preference for plants of a tropical nature such as the cucurbits, cotton, and orange. Southward this aphis occurs in the West Indies, Mexico, and Brazil, and doubtless elsewhere in South America. It occurs injuriously also in the Hawaiian Islands, South Australia, South Africa, and the East Indies.

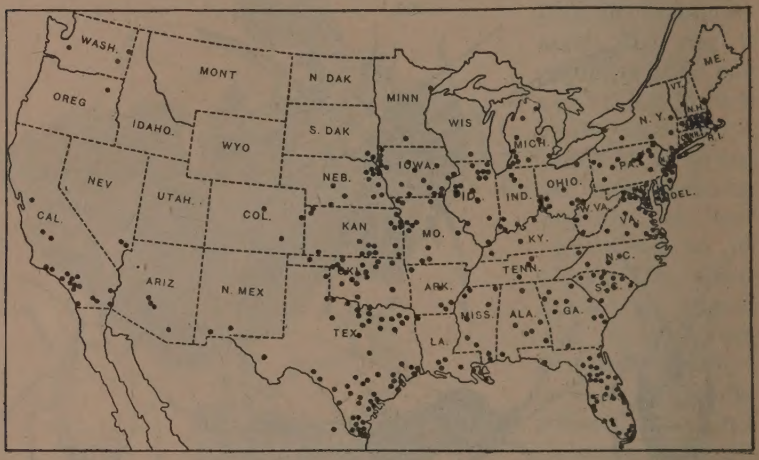


FIG. 3.—Map showing localities from which the melon aphis (*Aphis gossypii*) has been reported. Includes records up to March 20, 1917. The insect probably is present throughout the regions in which the dots are numerous.

It is very generally distributed throughout the United States (see fig. 3), and frequently is reported as doing more injury in the Southwest than elsewhere, although a serious pest in the Gulf region. In Texas, Kansas, and Nebraska it is particularly troublesome to melons, and, in the last two States, to cucumbers, which are extensively grown for pickling. At any time, however, it may create more or less trouble in northern and eastern regions, particularly in Maryland, Virginia, Delaware, and New Jersey, where cucurbits are much cultivated. Occasionally it is injurious as far north as Minnesota and as far west as California.

## SEASONAL HISTORY.

Damage to cultivated plants begins in early spring or later, depending upon locality and climate, and continues for some time.

It is caused by the winged individuals which fly from weeds and other vegetation serving as their other food plants. Infestation naturally commences earlier in the South than northward and may occur simultaneously with the appearance of the crop above ground. Soon after the plants have developed leaves a few winged plant-lice usually can be found, and these are the forerunners of the myriads which follow. As often as a plant becomes exhausted of its vital juices by the sucking of innumerable plant-lice, winged individuals are developed which fly to other plants, so that migration of the species is going on throughout practically the entire season.

Flight from one kind of food plant to another, or from one field to another, is due to atmospheric conditions, such as wind and rain, and to the abundant natural enemies of the insect. The great numbers of this species sometimes suddenly discovered on melons, cotton, orange, and other plants are often the result of enforced migration on account of the death of other food plants in the vicinity, such as might be caused by weather conditions or by the ravages of the plant-lice themselves or of other insects. The removal of the crop on which the insect has been working would have the same result.

## FOOD PLANTS.

### PREFERRED FOOD PLANTS.

The melon aphis is partial to the cantaloupe and other melons, cucumber, pumpkin, wild gourd, winter squash, and other cucurbits, cotton, okra, and orange and other citrus fruits, these being natural food plants on which the insects feed and multiply. When the cucurbits, cotton, and okra die down, the melon "lice" which have been feeding on them may migrate to citrus trees, which thus become, for these individuals, second-choice food plants. The other plants which have been attacked and on which the insect often is found colonized are probably second-choice food plants, since records do not show that the insect breeds upon these plants continuously. Perhaps this is not the case with certain plants grown in greenhouses, since the melon aphis has been found very commonly on greenhouse violets.

From the abundance of this insect on the favorite food plants recorded above, it has received a number of common as well as Latin names, the former including "cotton louse," "orange louse," "cucumber louse," and "cantaloupe louse." In greenhouses it is frequently known as the "green aphis" to distinguish it from lighter hued kinds and from forms such as the brown violet aphis.[1]

### OTHER FOOD PLANTS.

The following list includes what are apparently in the main either second-choice food plants, or plants on which the insect usually will not feed when cucurbits are near by: Hops, strawberry, beans.

[1] *Rhopalosiphum violae* Pergande.

sugar and table beets, spinach, tomatoes, asparagus, and several ornamental plants, including the hydrangea, begonia, ground ivy, acalypha, and morning-glory. It is also recorded as feeding on such common weeds as shepherd's-purse, peppergrass, great ragweed, dock, fleabane, milkweed, burdock, dandelion, lamb's-quarters, plantain, chickweed, and mallow. In the absence of their favorite food plants the winged forms are likely to start colonies on any of these or other plants which happen to be in the line of flight.

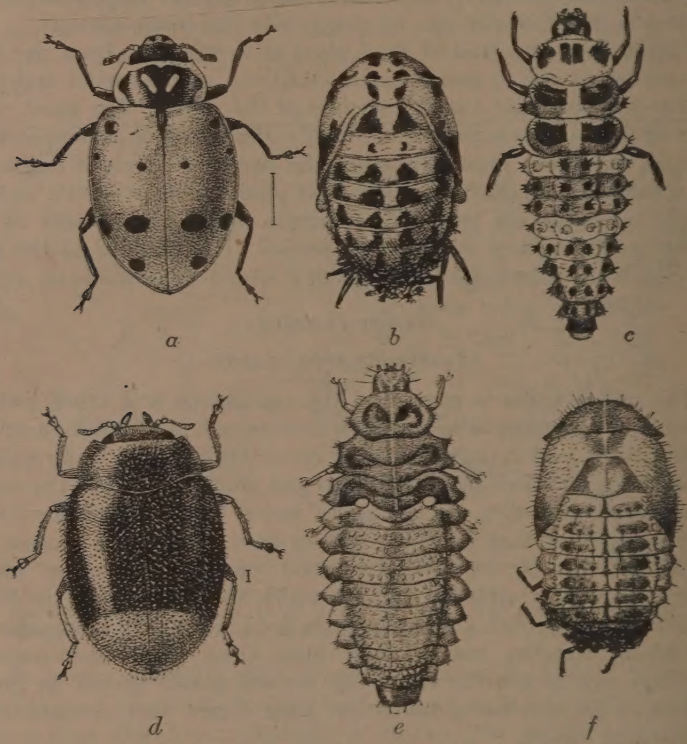


FIG. 4.—Useful ladybirds which prey upon the melon aphis and other plant-lice: *a*, Adult of convergent ladybird (*Hippodamia convergens*); *b*, pupa of same; *c*, larva of same; *d*, adult of *Scymnus terminatus*; *e*, larva of same; *f*, pupa of same. All greatly enlarged. Size indicated by hair lines at right of adults.

## NATURAL ENEMIES.

There is perhaps no better example among insects of a common and widespread species held in abeyance and limited to innoxious numbers, save in exceptional seasons, by natural enemies, than the melon aphis. The usefulness of these natural enemies, of which a large number have been recorded, in subduing the plant-lice can not be overestimated. Garden and field plant-lice generally are subject to attack by the same classes of parasitic and predacious enemies. The

number of insect species known to prey upon the melon aphis is about 40. The list includes many ladybirds, or "ladybugs," which destroy the plant-lice both as adults and as larvæ; the maggots of certain syrphus-flies, which consume large numbers of plant-lice; and aphis lions, which are the larvæ of lacewing flies. A number of species of minute parasitic, four-winged, wasplike insects are very important checks on the increase of plant-lice. Parasitic fungi also destroy many.

The insect enemies of these, as of other plant-lice, keep their hosts, in many portions of the country and in ordinary seasons, in nearly complete subjection. The parasites, in particular, are most effective in dry, warm weather. In cooler, moist summer weather, *especially when this follows the same atmospheric conditions in spring*, these otherwise natural checks are less active, and the plant-lice, as a result, frequently gain the ascendency.

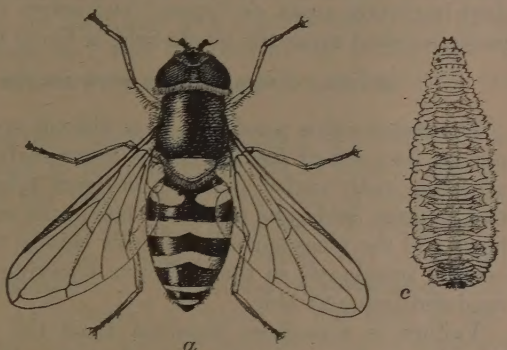


FIG. 5.—A syrphus-fly (*Syrphus ribesii*) which is an enemy of the melon aphis: *a*, Adult fly; *c*, larva or immature form. Much enlarged.

Two common species of ladybird enemies of this and other plant-lice are illustrated in figure 4. The most abundant and useful form of this class of insects is the convergent ladybird, shown at *a*, *b*, and *c*. Curiously enough, this is frequently mistaken for the parent of the plant-lice. Another very efficient enemy is shown in figure 4, *d*, *e*, *f*. One of the most abundant syrphus-fly enemies is illustrated in figure 5.

Of the natural enemies which have been enumerated, ladybirds are particularly valuable, owing principally to the fact that they are active at all seasons, especially *at the outset of aphis attack.*

Parasites are most effective toward the end of the season, when they often reduce the plant-lice so that few are left to hibernate and produce other generations of the pest the following year.

The value of these natural enemies against plant-lice is such that entomologists frequently advise the employment of remedies only when the enemies are not present in abundance. The ladybirds and some other hardy beneficial insects, which are practically always present on infested vines, often survive spraying and continue action thereafter.

## METHODS OF CONTROL.

### VALUE OF FREQUENT INSPECTIONS AND EARLY WORK.

*Severe losses by this species can be largely reduced*[1] *and in many cases actually prevented by the employment of control measures upon the first appearance of the insect.*

It should be borne in mind that the plant-lice attack first the underside of the leaves, and if injury is to be averted they must be combatted before the leaves have become crinkled and wilted and their upper surface covered with honeydew. (See fig. 1.) Manifestation of injury usually begins by the time the runners are a foot in length, but varies with temperature and locality.

The vines should be inspected at least twice a week, not alone in one part of the field but in several, as the insect is sometimes abundant in certain areas, or "spots," and scarce in others, and from the badly infested areas the whole field is likely to be overspread.

### GENERAL CONSIDERATIONS WITH REGARD TO SPRAYING.

The melon aphis would not be a difficult species to control were it not for its habit of feeding on the lower surface of the leaves, which are often badly curled as shown in figure 1, and for the further fact that in large fields, and especially late in the season, the leaves become large and the vines spread and grow closely together, frequently becoming interlaced, so that effective spraying by ordinary means is rendered impracticable.

Failure is sometimes reported from the use of such approved remedies as 40 per cent nicotine sulphate. In such cases the ineffectiveness of the spray is due nearly always to the use of the wrong formula, incorrect preparation, or careless application. The relative proportions of the ingredients should be maintained throughout the spraying.

In the use of any of the contact insecticides mentioned in this publication it should be remembered that their value is in direct proportion to the thoroughness of their distribution. None of them is effective unless brought into contact with the bodies of the insects. The undersides of the sprayed leaves should be examined from time to time, to see that they are being wetted, and this may be used as an index to the effectiveness of the spray. *The plant-lice will not be destroyed unless brought into direct contact with the spray.*

Insecticides are often applied to plants which already have been so checked in growth from aphis feeding that recovery is impossible. In these cases, obviously, the spraying can not be condemned as inefficient.

[1] It has not always been found possible wholly to prevent injury to young and tender plants, particularly cucumbers grown for pickling.

Hot, dry winds or a combination of cold weather and drought are likely to retard the growth of the plants and in years when plant-lice are abundant the unthriftiness of the plants may be due more largely to these untoward weather conditions than to the plant-lice. If this is the case, spraying, of course, will have little effect.

Unlike the large forms of sucking bugs which derive their food by the same method, as, for example, the harlequin cabbage bug[1] and the squash bugs.[2] all stages of plant-lice from the smallest nymph to the adult are equally susceptible to insecticides.[3]

### SPRAYING WITH NICOTINE SULPHATE.

As a spray for the melon aphis and other plant-lice, nicotine sulphate thus far has given the best results. Tobacco in different forms has been used with success, chiefly in the vaporization of greenhouses, since about 1894. It has been used to a considerable extent in later years for this purpose, and also to some extent in the field, but is being superseded by nicotine sulphate sprays and nicotine fumigating papers.

In later years it has been found that a solution of nicotine sulphate standardized to contain 40 per cent by weight of nicotine has given the best results. It has been tested practically wherever melons and other cucurbits are grown on a large scale, but especially in California, Illinois, Florida, Oklahoma, Texas, and several other States, both by representatives of the Bureau of Entomology and by State entomologists and practical workers. It was used on one occasion at Turlock, Cal., on 800 acres of watermelons and cantaloupes with excellent results.

While 40 per cent nicotine sulphate is recommended for the melon aphis, careful application is required as in the case of all other insecticides.

Nicotine sulphate is used according to what is known as the 1–1,000 formula, or 1 part of 40 per cent nicotine sulphate to 1,000 parts of water. To this mixture should be added sufficient soap or similar spray material to act as a "spreader." Common laundry soap is cheap, easily obtainable, and satisfactory for the purpose. The amount required may be estimated on the basis of 1 pound to each 25 gallons of the mixture.

The following formula will be found to combine the ingredients in the proper proportions:

| | | |
|---|---|---|
| Nicotine sulphate, 40 per cent | fluid ounces | 3 |
| Yellow laundry soap | avoirdupois pound | 1 |
| Water | gallons | 25 |

[1] *Murgantia histrionica* Hahn.

[2] *Anasa* spp.

[3] In the case of the large sucking bugs, the last two stages are very difficult to destroy with any form of contact or other insecticide.

On account of the low, spreading nature of the vine growth a much more even distribution of the spray is effected by a power sprayer than by a hand-operated machine. Such a sprayer may be equipped with four lines of hose, each fitted with a spray rod and one or more wide-angle nozzles provided with elbows. With this outfit four men may spray at one time, each man having a spray rod and covering a separate row of vines. For spraying vines grown in hills a hand sprayer is generally used. See "spraying machinery and appliances," pages 13 and 14.

### SPRAYING WITH SOAPS.

Soaps of nearly every kind are valuable as sprays for the control of the melon aphis and others of its kind. Both hard and soft soaps, manufactured from fish oil, are much employed.

For use on the melon aphis about 8 pounds of soap to 50 gallons of water will make an emulsion of sufficient strength, but it may be used a little weaker or, if necessary, considerably stronger without injury to the plants. This will destroy not only the melon aphis but any minute leaf-bugs, thrips, or other insects which happen to be present.

Soaps possess no particular value over kerosene-soap emulsion, but they are more readily prepared. Special fish-oil soaps which are combined with tobacco or resin are used on field crops, and soaps combined with naphtha, cresol, and distillates.

For use in greenhouses neutral soaps of the castile and physicians' and surgeons' type are much used, both for the control of this insect and for the red spider, thrips, and other minute, soft-bodied pests.

Soap sprays are applied in the same manner as nicotine sulphate spray.

### SPRAYING WITH KEROSENE EMULSION.

Kerosene-soap emulsion, a standard remedy for sucking insects such as plant-lice, is of secondary value to the nicotine sulphate solutions, and is prepared by combining 2 gallons of kerosene and one-half pound of fish-oil soap or 1 quart of soft soap with 1 gallon of water. The soap is dissolved in boiling water and then poured while still boiling hot (away from the fire) into the kerosene. The mixture is then churned rapidly for about five minutes, the liquid being pumped back upon itself by means of a force pump and direct-discharge nozzle throwing a strong stream. At the end of this time the mixture will have become of the consistency of cream. Properly prepared an emulsion will keep almost indefinitely, and should be diluted only as needed for use. For most kinds of plant-lice the staple emulsion should be diluted with from 10 to 20 parts of water.

In the preparation of kerosene emulsion a force pump is a necessity, since if not made according to directions a perfect emulsion will not

be formed. There is then danger of injury to the plants by the kerosene, as also useless waste. There is danger and waste, too, if the insecticide is not applied by means of a fine nozzle in the form of a spray, which should be fine and mist-like, or "like a fog," as some one has aptly expressed it. It should be sprayed only for a long enough time to cover the plants, otherwise the liquid will form into globules and run off. Figure 6 illustrates the method of operating a compressed-air sprayer so as to produce an underspraying. In the case of the cucumber, more thorough work can be done by two men than by one, as shown in the title-page illustration, in which the man on the left is holding up the vine so that the man on the right can spray thoroughly the lower surface of the leaves. By this method a single spraying frequently will suffice.

FIG. 6.—Method of underspraying cucumbers with compressed-air type of sprayer.

#### SPRINKLING OR SPRAYING WITH WATER.

Where a few plants only are infested, and it is possible to direct a strong stream of water upon them from a garden hose, syringe, or spraying machine, so as to wash off the insects, this aphis can be materially checked without the use of other substances. Those insects that come into direct contact with a stiff spray of water are unable to survive, while others that are dislodged from the plants do not succeed in returning. Many are wingless during the greater part of the season and are unable to crawl any distance, particularly if the ground be dry and hot.

#### SPRAYING MACHINERY AND APPLIANCES.

Various types of spraying machinery may be employed, but for spraying cucumbers a hand sprayer is much used. (See fig. 6 and title-page illustration.) This should be fitted with a spray rod having an upturned elbow and a nozzle of the vermorel or eddy chamber (fig. 7) type, so that the spray may reach the underside of the leaves.

In large commercial plantings of melons the amount of hand labor required in spraying with small compressed-air sprayers becomes somewhat costly, and a traction or gasoline power sprayer is preferable. The type ordinarily used is a traction machine, operated by one or two horses, a practical form of which is illustrated in figure 8. The nozzles are so arranged as to work close to the tops of the plants, and one to three rows may treated at one time, especially while the vines are young. A pressure of about 150 pounds may be developed and with the close placing of the nozzles this pressure moves the leaves about in such a manner that both the under and upper surfaces become thoroughly wet by the spray.

A sprayer of the type manufactured by at least one company in the United States, although designed especially for work with onions, is

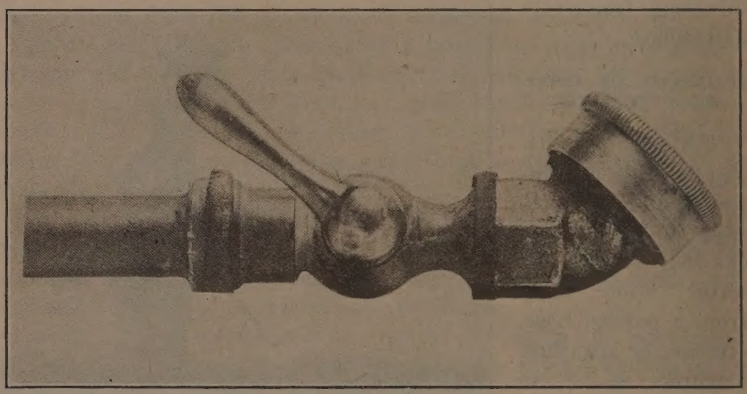

FIG. 7.—Angle disk nozzle for undersprayiug.

applicable for such crops as melons as well. In this sprayer, which is of the large gasoline-power type and is so arranged as to draw a 250-gallon tank by means of horses, two long arms of ¾-inch pipe, each about 35 feet long and supported by a steel wire truss, are used. To the ends of these pipes are attached two 25-foot lengths of hose, each length being fitted with a 15-foot extension rod equipped with an angle or elbow and a pair of nozzles. With such an apparatus a space 100 feet wide can be sprayed readily by three men, one to act as driver and engineer and the other two to handle the nozzles. The pressure available through the power equipment secures an unusually thorough distribution of the spray with resultant destruction of the plant-lice. The arms of pipe leading to the hose are fitted on swivel connections, so that while the sprayer remains standing an area approximately 100 feet square can be sprayed. This necessitates turning the vines into the rows on a comparatively small portion of the field.

### CARBON DISULPHID FUMIGATION.[1]

The carbon-disulphid treatment of the melon aphis has been employed successfully for some time and is valuable in small fields, but less profitable where cucurbit or other crops are grown over large areas. It consists in evaporating carbon disulphid (known also as carbon bisulphid, bisulphide of carbon, etc.) under tubs, or similar *tight* receptacles or covers such as large pails, buckets, or boxes. The chemical is employed at the rate of 1 dram (about a teaspoonful) to each cubic foot of space; 2 drams, or a tablespoonful, will serve for ordinary small tubs. This method of treating the plant does not injure it, and if the tub or other cover fit tightly to the ground so as to retain the vapor of the disulphid, all of the plant-lice which are covered will be killed. This method has been used successfully in moderately large fields, but the grower must be careful to watch the vines for the first appearance of the insects and treat promptly the hills that require fumigation, removing and destroying plants that are badly affected to prevent the spreading of the infestation to others.

Caution.—In the use of carbon disulphid as a fumigant for the melon aphis or other plant-lice the usual precautions should be observed not to expose the carbon disulphid vapor to fire, as it is inflammable and explosive if mixed with air in certain proportions. *The operators must not smoke during this process.* As the gas is heavier than air there is no danger, if ordinary care be observed, that the vapor will be inhaled by human beings.

### CULTURAL METHODS.

Cultural methods give considerable promise in control. Clean gardening or farming with fall plowing should always be practiced, as this forms a most valuable measure of prevention of injury by this and other insects that are almost always present in the same fields. As soon as the crop is off, the remnants should be gathered and burned. All weeds in the vicinity should be kept down throughout the year, including late fall and early spring, since, as has been shown, the common weeds of the field and garden are available as food plants and serve as the hibernating quarters of the melon aphis, which feeds more or less throughout the warmer periods of winter. On weeds the insects can be found feeding, in a climate like that of the District of Columbia, until January, even after heavy frosts or snow, and again in March.

When cucumber or other plants become badly infested it is an impossibility to secure a crop of fruit. In such a case about the only measure that can be profitably undertaken is simply to dig out and bury the plants with the plant-lice on them as they are noticed when the hills are turned over for cultivation. In small gardens

[1] See also Farmers' Bulletin 799, "Carbon Disulphid as an Insecticide," which may be obtained free on application to the Division of Publications, United States Department of Agriculture.

single plants may be pulled and covered over with a spadeful of earth to prevent spread of the infestation. This method is very generally practiced for the melon aphis as well as for many other truck-crop pests. Where the vines can be burned promptly this is still more valuable, as it insures the death of other insects, such as squash bugs, which are likely to be present at the same time.

FIG. 8.—Traction sprayer for use on cucumber and other truck crops.

## CONCLUSIONS.

(1) Examine the melon or cucumber field in several places, from time to time, in order that the melon aphis may not cause serious damage before detection.

(2) When the aphis is found, *do not wait* to find out whether it is going to increase, but *begin spraying at once.*

(3) Be sure to use the correct formula, and apply it properly and thoroughly, making frequent inspections to ascertain that the undersides of the leaves are well covered.

(4) Use plenty of spray-mixture—200 gallons to the acre, if necessary—and apply at high pressure, say about 150 pounds, if possible.

*If the work is undertaken in time, and directions are carefully followed, there should be no difficulty in protecting a field of cucumbers or melons against the ravages of the melon aphis and obtaining a good yield.*